# Technical Report

**on Telecommunications Infrastructures within Multi-tenant Buildings in Support of the Joint Comments of**

**CORNERSTONE PROPERTIES**
**CRESCENT REAL ESTATE EQUITIES**
**DUKE-WEEKS REALTY**
**HINES INTERESTS LIMITED PARTNERSHIP**
**LEGACY PARTNERS**
**THE LURIE COMPANY**
**METROPOLITAN LIFE INSURANCE COMPANY**
**PRENTISS PROPERTIES**
**RUDIN MANAGEMENT COMPANY**
**SHORENSTEIN COMPANY**
**SPIEKER PROPERTIES**
**TRIZECHAHN OFFICE PROPERTIES**

*by*

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# I. INTRODUCTION

This *Technical Report on Telecommunications Infrastructures in Multi-tenant Buildings* has been prepared by Riser Management Systems, L.P. (Riser) in response to a request by Cornerstone Properties, Crescent Real Estate, Duke-Weeks Realty, Hines Interests Limited Partnership, Legacy Partners, The Lurie Company, Metropolitan Life Insurance Company, Prentiss Properties, Rudin Management Company, Shorenstein Company, and TrizecHahn Office Properties (Joint Commenters) to be submitted with their Joint Comments to the Federal Communications Commission in Docket Nos. 99-217 and 96-98.

Riser is a telecommunications design, engineering, management, and consulting firm based in Burlington, Vermont. Riser serves the real estate industry exclusively, assisting building owners in understanding and working within a competitive telecommunications environment to increase their tenants' access to and choice of sophisticated services. Riser firmly believes that providing tenants with ready access to competitive choice is in the best interest of the real property industry, as well as our entire society.

Since its founding in 1993, Riser has conducted infrastructure surveys of over three hundred commercial office buildings throughout the United States and Canada. Riser's engineers have physically examined, documented, analyzed, and reported on the conditions of telecommunications entrance cable, main cross-connect rooms, cable backbones, pathways, closets, rooftops, and equipment space in properties serving tenants with sophisticated and high-capacity telecommunications needs. In addition, Riser has reviewed, analyzed, negotiated, or drafted over one thousand lease and license agreements defining rights and obligations of access for local and long distance telephone service, cable TV, Internet service, wireless or rooftop use, shared tenant services, and general telecommunications access or service.

Riser leads the industry in designing and engineering new, state-of-the-art telecommunications infrastructures that offer all of a building's tenants ready, non-discriminatory access to a variety of services and telecommunications service providers (TSPs). Riser also provides competitively neutral, third-party cable management services in more than 11 million square feet of U.S. and Canadian office properties. Riser's multi-disciplinary staff includes telecommunications, wireless, electrical, and civil engineers; industry experts; attorneys; telecommunications analysts; MIS programmers; and customer service specialists with decades of experience in telecommunications—from Bell Operating Company central offices to nationwide fiber-optic buildouts.

Based on this experience, Riser submits to the Joint Commenters this technical report, which places the telecommunications infrastructure within the context of a multi-tenant building, describes observed installation and operating practices of TSPs within multi-tenant buildings, and discusses the effects of these practices on the condition of telecommunications infrastructures in multi-tenant buildings and on tenant access to competitive telecommunications services.

# II. MULTI-TENANT BUILDING INFRASTRUCTURES

At the most fundamental level, multi-tenant buildings have two types of space: tenant space and building space. Building owners rely on tenant space for operating revenues and profit margin. To serve tenants, however, multi-tenant buildings also require a certain amount of "common" space[1] for personnel (e.g. lobbies, hallways, and restrooms) and supporting infrastructure (e.g. telecommunications, electricity, air conditioning, and elevators).

## A. Building Space Distribution

Non-tenant, building space is typically concentrated at the top, bottom, and center of a multi-tenant building. This space is controlled by the building owner or manager and carefully managed to meet the current and expected needs of the entire building, including tenants, critical infrastructure, supporting services and amenities, and overall security. Telecommunications is just one of a host of utilities and services that requires space in these areas, which are naturally designed to be as small as possible, leaving the maximum area of rentable space.[2] This situation inevitably causes congestion in these building spaces, which, although economically efficient, requires that the building owner manage these spaces carefully.

### 1. Rooftop Space

The rooftop of a multi-tenant building often supports a variety of building, tenant, and third-party equipment. Building infrastructure equipment frequently includes HVAC[3] fans and condensers, ventilation shafts, and light fixtures and window washing davits around the periphery of the roof, which often means that all rooftop installations must be several feet removed from the edge of the roof. Depending on the building design, the rooftop or penthouse may feature a retail attraction or tenant amenity such as a restaurant, viewing deck, or fitness club. Such development may significantly limit rooftop development for telecommunications in order to ensure that radio frequency (RF) levels remain below the required, safe threshold for human exposure.

Building tenants may have installed VSAT[4] dishes, satellite dishes, or other communications devices on the rooftop to deliver dedicated service to their rented space. In addition, third-party TSPs often seek to install equipment on building rooftops. These providers fall into two general categories: tenant-based and platform providers. Tenant-based providers seek to deliver telecommunications service to building tenants through wireless means. Tenant-based providers may also seek additional rooftop space for a "hub" or "nodal" site to complete part of their larger wireless network. Platform providers use the building's rooftop to serve telecommunications users off-site, and include TV and radio broadcasters, PCS and cellular providers, and paging and LMR[5] companies.

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[1] Although "common" space serves the common needs of tenants, such space is controlled strictly by the building, and is not usually accessible to tenants. The term "common space" is therefore something of a misnomer; this space will henceforth be referred to as "building space."

[2] In practice, tenants' rent usually covers payment for the tenant's fair share of building space, which is referred to as "loss factor." To remain competitive in the real estate market, building owners seek a minimum loss factor.

[3] Heating, Ventilation, Air Conditioning.

[4] Very Small Aperture Terminal. A relatively small satellite dish, typically 1.5m-3m in diameter.

[5] Land Mobile Radio.

A particular rooftop's suitability for supporting wireless telecommunications equipment also depends largely on the building's design. For example, a building's design may include many setbacks (creating the tapered shape of older high-rise silhouettes), giving the building many small "stepped" rooftops instead of a single large one. Many rooftops are designed primarily as a crowning feature of the building's architecture, with eye-catching louvers, metalwork, or steep pitches. Such architectural "caps"—New York City's Chrysler Building is a prime example—may preclude the placement of any type of equipment on the rooftop. On the other hand, some building rooftops, usually those most amenable to wireless telecommunications, have been equipped with a superstructure to support antennas. Such investments are either made by a rooftop management company (such as Motorola) or by the building owner.

## 2. Upper Floor Space

One to three of the uppermost floors in high-rise multi-tenant buildings are also typically reserved for building use. These floors must support many types of building mechanical equipment, including elevator motors and control systems; HVAC chillers, condensers, fans, pumps, boilers, and return valves; the house water tank and supporting fire safety systems; and emergency power generators. Furthermore, safety codes and regulations require that much of this equipment be housed in physically separate, secure areas. For example, elevator motors and systems may not be collocated with any other type of equipment. Electrical equipment must be well protected and physically separated from systems that use or process water in any form. Telecommunications equipment must be separated from electrical and radio sources that could disrupt telecommunications services. In addition, pipes, ductwork, and steel girders to support a rooftop structure, if any, must route through these spaces. The sheer size, fixed nature, and design specifications of all of the above equipment often make it difficult to identify and allocate spare space for new uses.

Rooftop telecommunications antennas require supporting equipment and electronics, which, if possible, are housed on the mechanical floors directly below the roof. A typical equipment cabinet for PCS, cellular, and paging systems is 22 in. x 22 in., meaning that several cabinets can be placed in a relatively small space. FM radio or TV broadcast equipment, however, is substantially larger (4 ft. x 4 ft.), and nearly always requires a dedicated space of 10 ft. x 10 ft. Supporting equipment for tenant-based providers averages 10 ft. x 10 ft.; if the provider operates a hub or nodal site, it often requires more equipment, occupying as much as 20 ft. x 20 ft. of area. This telecommunications equipment must, however, compete for space with the essential building equipment and facilities described above. Ideally, the building's design includes one or two electrical rooms specifically for telecommunications, typically 400 sq. ft. in area. Often, however, antenna equipment is located in a caged space partitioned out of a larger room. If no space is available for antenna support equipment within the building, a portable, climate-controlled "hut" can sometimes be placed on the rooftop, if there is adequate space and structural support.

## 3. Basement Space

The basement of most multi-tenant buildings is similarly reserved for building functions and equipment. Basement space typically houses HVAC systems, janitorial and maintenance storage, emergency generators, and electrical and telecommunications equipment. In urban areas, tenant parking is also frequently located on the basement and/or lower levels.

Telecommunications services typically enter multi-tenant buildings on the basement or ground-level floor through TSP entrance cable. TSPs thus require basement space in which to terminate these entrance cables and cross-connect to their riser cables for distribution upward to tenant space. Nearly every multi-tenant building has a Main Cross-connect room, which houses the ILEC's main distribution frame and other equipment. Main Cross-connect rooms often contain ample space to support equipment rooms, or points of presence (POPs), for competitive TSPs, but such collocation is rare. Depending upon the nature of the subscriber service delivered, a POP can consume 200 sq. ft. of space or more. Competitive TSPs nearly always request a dedicated space in which to locate their equipment, requiring the building to furnish an entirely new space with significant amounts of power, lighting, HVAC, and access control. If no spare space is available in the basement to accommodate additional services, an additional structure such as a rooftop "hut" is not possible in the basement. The building owner must re-allocate and re-organize the existing space, if possible, to accommodate the building's changing needs for a particular utility, service, or essential building function. As in the upper floor spaces, however, the sheer size, fixed nature, and design specifications of all of the above equipment often make it difficult to identify and allocate spare space for other uses.

## 4. Core Space

Additional building space is located in the center or "core" of the building, surrounded by tenant space on the periphery. In most multi-tenant commercial office buildings, core space on each floor contains fire stairs, elevators, bathrooms, hallways, a janitorial/maintenance room, an electrical room, HVAC equipment, and a telecommunications closet. In a multi-tenant residential building, core space typically contains everything listed above except the bathrooms and the janitorial room.

### a. Telecommunications closets

The use of building spaces at the top and bottom of a building has changed very little since the advent of high-rise building design. The design and use of telecommunications closets, however, have changed substantially over the past few decades.

***Design***

Prior to 1970, telecommunications service was not competitive, and residential and commercial tenant demand for telecommunications service was generally static. Accordingly, building designers usually planned for electrical and telecommunications facilities to be housed in one room. The combined telecommunications/electrical closets in buildings built before 1970 are only about 3 ft. x 4 ft. in size, and at the time, telecommunications services placed few demands on the small closet space. There are tens of thousands of operating commercial and residential multi-tenant buildings over 40 years old throughout the United States.

In the period from 1970 through the mid-1980s, telecommunications design in multi-tenant buildings underwent a revolution. Even prior to the divestiture of AT&T in 1984, the growing importance of telecommunications services was becoming evident. Building designers began to recognize the many potential hazards caused by placing telecommunications and electrical infrastructures in the same space.[6] Increasingly, new buildings were designed so that electrical and telecommunications facilities occupied either equal shares of an expanded telecom/electrical space, or separate spaces entirely. Buildings constructed during this period often contain a space approximately 3 ft. x 3 ft. in size dedicated exclusively to telecommunications services.

Since the end of the 1980s, multi-tenant building design has experienced smaller, incremental changes. Although some contemporary buildings have a dedicated core telecommunications space—sized at 5 ft. x 5 ft. or larger—many current building designs still combine telecommunications and electrical services in a single common space, despite clear standards to the contrary.[7] The economic incentive to conserve building space (and maximize rentable tenant space) coupled with inadequate knowledge of building design standards for telecommunications has resulted in the continuation of pre-1990 telecommunications design practices.

Consequently, the owner of a multi-tenant building must accommodate the building's changing needs within a fixed amount of building space—additional building space cannot be created, only re-allocated. The growing demand for new and additional telecommunications services heightens this challenge, requiring careful configuration and management of a fixed amount of space. At the top and bottom of the building, where telecommunications facilities are often accommodated in small (e.g. 100 sq. ft.) areas, re-organization of space is a moderate challenge. The building owner's control of the entire floor allows greater flexibility in reallocating space. On tenant floors, however, the challenge of accommodating demand for telecommunications space is far greater. Building owners and managers must accommodate ever-increasing tenant telecommunications demand within the constraints of telecommunications closets sized at an average of only 3 ft. x 3 ft.[8]

***Use***

Because telecommunications closets are so small, it is important to understand the many functions they perform in deploying telecommunications services within a multi-tenant building. Telecommunications closets support the cable pathway, "backbone" demarcation, tenant equipment, TSP equipment, and non-telecommunications equipment.

<u>Cable pathway</u>. Telecommunications services originate at the TSPs' equipment space in the basement or on the rooftop, and reach tenant floors through various types of cable. These cables are nearly always run through the telecommunications closets, which are usually vertically aligned. The cable pathway runs through sleeves, slots, or conduit placed in holes or "cores" in

[6] For example, electro-magnetic interference (EMI) from high-voltage electrical wire could disrupt telecommunications service, and telecommunications technicians (who are often not licensed electricians) require access to the closets, creating a safety risk.

[7] ANSI/TIA/EIA-569-A, 7.2.1.1, pg. 65 states: "Telecommunication closet space shall be dedicated to the telecommunications function and related support facilities. Telecommunications closet space should not be shared with electrical installations other than those for telecommunications." ANSI/TIA/EIA-569-A is the prevailing commercial building standard for telecommunications pathways and spaces.

[8] ANSI/TIA/EIA-569-A is the prevailing commercial building standard for telecommunications pathways and spaces. Section 7 of this standard offers guidelines for a telecommunications closet that is sized to support the "shared use of the telecommunications closet space for the telecommunications needs of all occupants of the area served." For an area of 10,000 square feet (roughly half the area of a typical multi-tenant commercial office building floor), the standard suggests that the closet be sized at 11 ft. x 10 ft., or over ten times larger than actual conditions found in buildings with floors of twice that area.

the floor of each closet. Floor cores are usually located against a wall of the closet to use the space efficiently. Therefore, the cable pathway consumes both floor space and wall space within the closet.

Backbone demarcation. A large cable system distributed to the entire building is commonly referred to as a cable "backbone." At each tenant floor, the ILEC's or TSP backbone usually contains a demarcation point, a frame or block that allows pairs to be cross-connected from the cable backbone to a tenant cable that that routes horizontally to tenant space. These cable demarcation frames are wall-mounted, thus consuming closet wall space.

Tenant equipment. Tenants have historically used telecommunications closets as a primary place for locating their telecommunications and data network equipment. This practice has been broadly embraced by multi-tenant building tenants and (until recently) has been accepted as a "given" by building managers. Thus, tenant equipment also frequently consumes closet wall and floor space.

TSP equipment. TSPs frequently locate in telecommunications closets any equipment they install to support tenant services. This equipment is most commonly mounted on the closet wall, but can also consume floor space.

Non-telecommunications items. Telecommunications closets are often used for many purposes other than telecommunications. Telecommunications closets frequently share space with other building infrastructures such as electrical distribution and HVAC facilities. Because these closets are typically vertically aligned (stacked on top of each other), they are used as pathway for non-telecommunications services such as plumbing pipes and electrical conduits. The closet size may be increased to support such additional use, but the area dedicated to telecommunications remains limited to an average of 3 ft. x 3 ft. Telecommunications closets also frequently contain building electronics that control day-to-day operational settings such as security, lighting, and climate control.

Advances in building operational technologies continue to create new demands for space within closets and pathways. For example, in Chicago, chilled water for HVAC use is available from third parties and can be brought into the building from beneath the city streets. To reach HVAC facilities on tenant floors, this water must be piped upward through the building. Telecommunications closets are often among the few vertical pathways available in a building, and may need to accommodate this additional function. Such developments and technologies that may require additional closet and pathway space are impossible to predict, and were certainly never considered in closet design. Building owners, however, must often modify closet space allocation in order to support such critical building services.

Other items. The many types of personnel that access telecommunications closets—TSP and other telecommunications technicians, electricians, building and tenant personnel—frequently store support materials such as tools and lamps in the closets.

Taken individually, each of the above functions consumes a manageable portion of a telecommunications closet's resources. In the aggregate, however, these multiple functions severely tax limited closet space and can easily create severe congestion. As tenant telecommunications demand continues to grow, and as more TSPs install cables and equipment, in some buildings these small spaces may eventually be unable to support additional facilities of any type.

# III. OBSERVED TSP INSTALLATION PRACTICES

Both ILECs and competitive TSPs require cable entrance facilities, equipment space, and vertical telecommunications cabling to deliver service to multi-tenant building tenants. The installation practices of these two groups of providers differ significantly in the latter category: vertical cabling. These differences are explained in detail below.

In general, however, ILEC and competitive TSP technicians perform work in a building's telecommunications spaces, particularly the closets, in a similar fashion. Technicians rarely appreciate the need for the same, small closet to support, say, another fifty years of telecommunications services and providers. TSP technicians have no incentive to economize on their use of limited telecommunications closet and pathway space. (Arguably, uneconomical use of the limited space could be considered a long-term competitive tactic, possibly preventing another TSP from routing cables through that floor in the future.) Installation practices vary from TSP to TSP and from technician to technician. Technicians generally aim to complete the installation, connections, or other work as swiftly and securely as possible, without considering how that work may affect a later installation.

## A. Typical ILEC Installation

In most multi-tenant buildings, the ILEC installs facilities at the time of building construction. ILECs also seek to upgrade existing facilities, install additional cabling or equipment, or establish another cable entrance at buildings they already serve. Sometimes the ILEC will present plans for the proposed work to the building owner for review and approval. Other times, however, ILEC personnel simply arrive at the building unannounced and ready to perform work. The building owner or manager must devote resources to (1) negotiating the terms and conditions for access to the building, and (2) negotiating, reviewing, and approving the construction plans and schematics, which reflect modifications to the building's infrastructure. To protect the building and its tenants, the building owner must address a host of potential legal, liability, insurance, operational, and management issues prompted by the ILEC installation. The building owner must ensure that the installation complies with all applicable codes and standards, does not create a present or future conflict with other building facilities, and, to the degree possible, does not compromise the building's overall strategic flexibility.

Building owners have had mixed results in negotiating such ILEC access. Most state tariffs obligate the ILEC to provide service to any customer requesting it, provided that the ILEC can reasonably gain access to the customer. Most ILECs consider any request by a building owner to sign an agreement or pay fees to be unreasonable. Rather than compromise or negotiate on terms of access, ILECs have threatened to not provide service, leaving building owners to choose between an unhappy tenant and conceding the ILEC's demands. Rarely have ILECs agreed to sign any form of agreements with the building to govern their installations and operations in the building.

## 1. Entrance Link

To connect a multi-tenant building to the local loop, ILEC entrance cables penetrate the building underground. In nearly every building, a sizable voice-grade entrance cable was installed at the time of building construction. To serve new buildings, or to expand cable capacity in older buildings, ILECs are increasingly installing fiber-optic entrance cables, which have a far greater capacity. These cables are contained within entrance pipes, called conduit, for protection from water and physical damage. The older the building, the smaller the likelihood that there will be spare conduits installed from the street for future entrance cable access.

To provide maximum survivability of communications, industry standards recommend that service cables enter a building at more than one location. Single points of entrance cause concern because a catastrophic failure (e.g. an explosion or fire) at a single point could disrupt all telecommunications service to the building. Ideally, ILEC service cables would enter the building from beneath two different streets, and each cable would originate at a different switching center (central office), creating “cable route diversity.” Most ILEC cable entrances, however, are not diverse.

## 2. Main Cross-connect Room

The Main Cross-connect room is the most important voice-grade telecommunications space for any multi-tenant building. The Main Cross-connect or Main Distribution Frame is the building’s voice-grade telecommunications “hub.” The room contains an access point for voice-grade entrance cables, which are cross-connected to the building’s cable backbone for distribution to tenant floors. Fiber entrance cables may terminate into multiplexers in this space, or the ILEC may have appropriated a separate “fiber room” elsewhere in the basement for this equipment.

The Main Cross-connect room is usually located in the basement and is typically quite large, in most cases more than adequate to accommodate the ILEC’s voice-grade distribution service. Main Cross-connect rooms must be located above expected flood levels (telecommunications equipment will malfunction when exposed to any amount of water, including high ambient humidity), well-lit, adequately cooled (equipment will malfunction when exposed to excessive heat), and inaccessible to unauthorized personnel (due largely to sabotage concerns).[9] Although the ILEC bears the responsibility for the cost of telecommunications equipment and installations, the building owner often pays for initial space construction and fit up (e.g., special HVAC, lighting, or power facilities) in order to ensure tenant satisfaction.

Most Main Cross-connect rooms in multi-tenant buildings house the ILEC’s distribution frame only. Because of the ILEC’s historical position as the main (often only) TSP in the building, the Main Cross-connect room is usually controlled solely by the ILEC, which historically does not pay rent for their space in the building. ILEC technicians nearly always use the room as a base for their operations in the building, and store office equipment and personal belongings in the space. Thus, any extra space that might be used to house competitive TSP equipment or frames is often consumed by items not related to telecommunications.

[9] TSPs often exclude even building management personnel from access to their spaces; an unusual practice given the building’s responsibility to ensure the safety of the building’s occupants.

## 3. Cable Backbone

From the Main Cross-connect room, the ILEC typically extends a voice-grade cable backbone upward through the building's telecommunications closets to deliver service to tenants. Until recently, the ILEC assumed sole responsibility for installing one or more cable backbones within multi-tenant buildings, usually at the time of the building construction.

ILEC cable backbone designs vary greatly depending on the age of the building. Cable design in older buildings focused on the expected needs of the building's largest, heaviest-use tenants. Smaller tenants' service needs were estimated through general assumptions about their aggregate demand plus an overhead factor, and the cable backbone was designed accordingly. Thus, in older buildings, Bell System designs differ from building to building. Furthermore, tenant demands for high-performance services commonly requested today were unheard of. For example, using the ILEC backbone for connection to the Internet via xDSL service could never have been anticipated fifty years ago.

Thirty or fifty years later, the tenant composition of these buildings has almost certainly changed—several times. Some of the larger tenants may have vacated the building and been replaced by many smaller tenants. Some initially small tenants may have expanded their occupancy in the building from a single floor to several floors. New tenants, large or small, may have moved in. To accommodate these changes, ILECs perform a series of modifications to the backbones of older buildings, adding new cables and re-directing existing cables to other areas of the building.[10]

Over time, such modifications progressively contribute to significant congestion of telecommunications closets and spaces. New cables consume wall, floor, and pathway space. What's more, in 25 to 33 percent of the buildings Riser has surveyed, copper cables have been simply cut and abandoned in place—because the Bells found it cheaper to install new cables than track the reallocation of existing pairs. Such cable installation practices limit the closet and pathway space available for additional telecommunications facilities and increase the likelihood of accidental tenant service disruption—the margin for human error is far greater in a disorderly closet.

In the past twenty years or so, ILEC cable designers have realized the significant costs—e.g., in copper cable and technician time—of continual cable modifications and installations. Accordingly, ILECs now typically design a uniform voice-grade cable backbone that provides each tenant floor with sufficient spare capacity for both flexible growth and changes in subscriber demand.[11] ILECs install a large-capacity telecommunications cable to serve the entire building—at significant costs, which were once included in the ILEC's operating expenses (today, the ILEC bills the building owner for the cost of the cable and installation). Such design allows the ILEC to connect readily to the building's tenants and to avoid costly and time-consuming new cable installations. Circuits on the cable backbone are interconnected to a

[10] Figure 1 depicts an example of early Bell System installation practices. This schematic of the cable plant of a 75-year-old multi-tenant commercial building in downtown Chicago clearly shows the repeated reconfigurations to the building's cable backbone over time to meet evolving tenant demand.
[11] See Figure 2 for an illustration of a contemporary uniform cable backbone design.

demarcation point within the telecommunications closet. From this demarcation point, tenant cable routes to their equipment, located either in their leased space or within the telecommunications closet.

# B. Typical Competitive TSP Installation

The Telecommunications Act of 1996 has produced rapid growth in the number of competitive local exchange carriers (CLECs). As a result, more and more CLECs and other competitive TSPs (e.g. Internet service providers) are approaching building owners and managers seeking access to their buildings—either to serve tenants or to use the building as a platform to serve off-site customers. Like ILEC installation practices, the typical installation practices of competitive TSPs significantly impact limited building pathways and spaces.

Competitive TSPs rarely seek access to a multi-tenant building until they have acquired a customer in the building. Once the TSP has acquired a customer, it evaluates whether its capital construction expense to connect to the customer is justified by forecast customer revenues. If the answer is yes, the TSP must gain the building owner's approval of the proposed installation work. The building owner or manager must devote resources to (1) negotiating the terms and conditions for TSP access to the building and its tenants, and (2) reviewing and approving the TSP's construction plans and schematics, which reflect modifications to the building's infrastructure to accommodate the TSP's presence.[12] To protect itself and its tenants, the building owner must address a host of potential legal, liability, insurance, operational, and management issues prompted by the TSP installation. The building owner must ensure that the installation complies with all applicable codes and standards, does not create a present or future conflict with other building facilities, and, to the degree possible, does not compromise the building's overall strategic flexibility.

## 1. Building Entrance Link

Depending on their service medium (wired or wireless), competitive TSPs connect a multi-tenant building to their local loop through an underground entrance cable or a rooftop antenna.

### a. Wired TSPs

After receiving the building owner's consent, a wire-based TSP installs entrance cable (most often fiber-optic) to the building at its cost. Each TSP (including the ILEC) installs its own dedicated conduit; a TSP will often install a spare conduit at the time of initial construction. Furthermore, TSPs increasingly seek to install a *second* cable entrance in order to establish cable route diversity and retain telecommunications service in the event of a catastrophic cable failure. The TSP then identifies a secure route (or routes) for its cables to follow from the building entrance point to its equipment room, which is usually in the basement.

### b. Wireless TSPs

TSPs that provide wireless-based service must establish a building entrance link on the building's rooftop. These TSPs locate (1) an antenna or array of antennas on the rooftop and (2)

[12] Submittal of construction plans for building approval is a relatively new practice. It is, however, a crucial part of managing telecommunications spaces in multi-tenant buildings. Unfortunately, most building managers do not retain a telecommunications expert on staff, and often approve construction plans that are poorly designed or do not use limited building space efficiently.

supporting equipment either in a climate-controlled enclosure (or "hut") on the rooftop, or in an equipment room in upper-level building space. In the latter case, cables connecting the TSP's antenna(s) on the rooftop to the supporting equipment must penetrate the roof membrane.

## 2. Equipment Room

Once the building entrance link is under construction, the TSP will construct and fit-up an equipment room, typically approximately 10 ft. x 10 ft. in size. The building may be able to simply grant the TSP a vacant office to accommodate its equipment. More often, however, building space in the basement and on upper-floor mechanical areas is severely limited and available only at a premium. For example, although underground parking spaces represent a tenant amenity and source of revenue to the building owner, it may be necessary to eliminate several parking spaces, and convert the area into a TSP equipment room.

TSP equipment rooms are often designed like computer rooms. They must be located above expected flood levels (TSP equipment will malfunction when exposed to any amount of water, including high ambient humidity), well-lit, adequately cooled (TSP equipment will malfunction when exposed to excessive heat), and inaccessible to unauthorized personnel (due largely to sabotage concerns).[13] Although the TSP bears the responsibility for the cost of telecommunications equipment and installations, the building owner often pays for initial space construction and fit up (e.g., special HVAC, lighting, or power facilities) in order to ensure tenant satisfaction.

## 3. Customer Cabling

To deliver tenant service, a TSP must install cable from its equipment room to the tenant's space in the building. In multi-story buildings, the TSP's cable routes to the proper floor through the core telecommunications closets. Typical cable installation practices of competitive TSPs differ from those of the ILECs, however. Competitive TSPs do not have the financial resources and guaranteed rate of return that the ILEC enjoys. Although a uniform, robust cable backbone[14] serving the entire building has clear advantages—primarily the strategic benefits of long-term flexibility and the efficient use of limited closet and pathway space—it is considerably more costly than a single cable routing to the tenant requesting service.[15] Single cable installations reduce TSP construction costs and speed service delivery. TSPs rarely provide for serving additional customers in the building in their initial installation plans. Accordingly, competitive TSPs usually install only sufficient cable to meet their individual customer's near-term needs for telephone, Internet, data, or video service. When a TSP acquires a new customer in the building, it installs a new cable from its equipment room to the tenant's floor.

This single-cable (or "home run") approach may be less expensive, but over time it aggravates closet congestion and impairs every TSP's ability to serve tenants. Each TSP with access to the building will install a home run cable to each tenant it serves. Over time, closet and riser congestion increases as more and more cables pass through the closets. The heaviest congestion is usually found on the lower floors, because the basement typically serves as the building telecommunications "hub." With the growth of wireless-based service distributed from the top

[13] TSPs often exclude even building management personnel from access to their spaces; an unusual practice given the building's responsibility to ensure the safety of the building's occupants.
[14] See Figure 2 for a schematic illustration of a typical uniform cable backbone design.
[15] See Figure 3 for a schematic illustration of a typical home run cable backbone design.

of the building, however, upper level congestion will also increase. Building telecommunications designs that did not anticipate this relatively new wireless-based technology may aggravate this problem—the number and size of conduits and pathways in closets often decreases from lower to upper floors. Unlimited and unmanaged cable installations will eventually completely fill the closets and pathways, leaving no room for additional competitors.

TSPs' motivation to contain costs can also effectively discriminate against competitive access by tenants on upper floors of a high-rise building. Because the TSP's equipment room is usually located in the building's basement or lower floors, the TSP's installation cost to deliver service to a tenant on, say, floor 2, is far less than its cost to deliver service to a tenant on floor 20. Accordingly, upper-floor tenants may be denied access to a wire-based TSP's service unless the TSP can expect a level of revenue that would justify the increased construction cost, or the tenant is prepared to pay a premium for installation of the desired telecommunications service. Of course, the inverse may be true concerning lower-floor tenant access to wireless-based competitors with entrance and equipment facilities at the top of the building.

# IV. EFFECTS ON BUILDINGS

Building management personnel, building tenants, and TSPs all vie for access to and use of the limited building-controlled spaces within multi-tenant buildings. Building owners have long had to manage limited space to meet the needs of their many tenants and the parties that serve them, and increased tenant demand for connection to competitive telecommunications services and TSP demand for building access and space has heightened this challenge. Granted adequate control and latitude to make sound decisions regarding the operation and management of their buildings, owners have successfully accommodated TSPs in a variety of ways. TSP access and installation practices nonetheless impact multi-tenant buildings significantly, and building owners and managers must contend with a host of issues, including heightened security, increased fire protection, exposure to liability, and the need to manage the building's limited spaces.

## A. Infrastructure Degradation and Closet Congestion

Heightened demand on building-controlled (as opposed to tenant-controlled) spaces can subject the building's infrastructure to accelerated degradation over time. Because the life cycle of a building is counted in decades, not years, building owners increasingly look to cable and infrastructure management practices as a means of protecting the building's strategic flexibility. Although the cost of such practices can be considerable, the cost of failing to adequately plan for the building's life cycle needs can be greater still.

In multi-tenant buildings nationwide, telecommunications closets—the critical final link for TSP connection to tenants—are suffering from advanced degradation.[16] Clogged with operating and abandoned ILEC, competitive TSP, and tenant cabling and equipment, these closets form a potential bottleneck between the vital connectivity needs of today's business and residential tenants and the providers that serve them. Without significant changes in the management of these closets, tenants will soon be unable to efficiently change or repair their telecommunications service. The following faults provide evidence of this degradation:

[16] Exhibit 1 shows photographic images from a failed telecommunications closet.

## 1. Active Hardware and Cable

TSPs, tenants, and tenant vendors with active hardware and cable in telecommunications closets will require regular access to those closets to maintain their cable plant. This regular access by multiple parties can severely compromise closet security and increase building liability (see *Security* and *Liability* below). Active hardware and cable also consumes limited telecommunications closet wall space.

## 2. Inactive Hardware and Cable

Users of telecommunications closets have little motivation to remove cable and hardware that is no longer in service from telecommunications closets and pathways. Closet wiring is often congested, confusing, and unidentified. No TSP or tenant wishes to expend costly labor resources for the removal of inactive facilities. TSPs, including the ILEC, will remove inactive items from telecommunications closets only when the requesting party agrees to compensate the provider for their labor.[17] As a building ages and inactive hardware and cable are not removed, these abandoned facilities create a level of congestion that makes navigation and work in these closets difficult.

## 3. Active Electronics

Users of telecommunications closets frequently install telecommunications electronics in the closets because of their proximity to TSP and ILEC networks. Placement of such electronics in these small spaces frequently results in problems for several reasons:

- In especially small telecommunications closets, placement of electronics consumes floor and wall space and renders navigation in the space difficult, if not impossible.

- Working equipment in the closets creates an environment in which non-building personnel require ready access to these spaces. This breach of security and loss of control over the use of the space results in increased liability for the building (see S*ecurity*, below).

- Electronics generate heat as a byproduct of their operation, increasing the temperature of the space, endangering the successful operation of the equipment, and potentially taxing HVAC systems (see *Increased Closet Temperature*, below).

- In most cases, the building owner is responsible for the utilities serving the closets. Electronics that use telecommunications closet power do so at the cost of the building, not of owner of the equipment. Furthermore, the building may be held liable for damages in case of a closet power outage, spike, surge, or brown-out, and any associated electronic equipment failure.

## 4. Inactive Electronics

At minimum, inactive electronic equipment merely taxes closet space needlessly. At worst, it may be connected to closet power outlet(s), drawing building power and generating unnecessary heat. Over the course of our surveys of multi-tenant buildings, we have seen literally tons of equipment that had been installed by the former Bell system (when it regularly provided

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[17] Increasingly, building owners are recognizing the disparity between the physical dimensions of telecommunications closets and the diverse demands placed on these limited spaces and are requiring relocation of this equipment to tenant leased space.

equipment on tenant premises) and was never removed after the 1984 divestiture. TSPs, including the ILEC, will remove inactive equipment from telecommunications closets only when the requesting party agrees to compensate them for their labor. In today's competitive environment, TSP activities can reasonably be expected to increase such closet activity, resulting in a significant increase in the volume of new electronics placed in telecommunications closets.

### 5. Increased Closet Temperature

Our field surveys regularly find excessive ambient heat in telecommunications closets. A power transformer and/or tenant or TSP electronics in the space may cause such elevated temperatures. Electronics may operate intermittently or fail altogether when exposed to minimally elevated temperatures (usually 80.F or higher). Thus, building liability may be increased if these electronics fail due to excessive heat buildup in the equipment. Elevated temperatures in closets that contain active electronics may require the installation of air conditioning equipment, possibly at the building's expense. Excessive closet heat is not a problem when active electronics are absent from the closet.

### 6. Trash and Stored Items

Trash and stored items pose fire hazards, inhibit work and navigation, and indicate building personnel are using these spaces inappropriately. In many cases, the contact points of telecommunications terminals are exposed, and tenant service could be disrupted by contact with a stored item.

## B. Security

Because telecommunications closets perform many functions, numerous individuals—building, tenant, and TSP personnel—all require daily access to these closets, which contain both facilities that serve all building tenants and facilities that serve an individual tenant or TSP. The building owner is responsible for ensuring the safety and security of all occupants and visitors to the building, and for meeting the needs of all the tenants. Heightened security is therefore required to reduce the likelihood of accidental or intentional damage to any facilities or equipment and to reduce the building's liability.

Each incident of access to these spaces represents potentially unsupervised work performed in a third party's (the building's) space. These routine entries can create significant problems for which the building owner or manager may be held accountable. For example, accidental (or intentional) disruption to tenant service could result in significant loss of business (and revenue) to the affected tenant. Worse still, a spark thrown by an improperly performed electrical connection in a closet could land on paper rubbish left by the last person in the space, resulting in a fire. Frequent, unmanaged access to these closets poses a variety of risks to the building and its tenants.

Therefore, the building owner must control and actively manage all access to building telecommunications spaces, and increased requests for access by competitive TSPs add to the costs of implementing and administering this security. The building must monitor TSP requests for access to spaces both during and after the cable installation, whenever the TSP is called upon to maintain or repair its customer's telecommunications service. Building owners must keep an accurate log of time and purpose of access, actual work performed, and time of exit in order to protect themselves from liability claims and ensure proper security.

## C. Fire Safety

Telecommunications spaces, including TSP equipment rooms and closets, contain equipment that is powered by high-voltage electricity, and the components of most telecommunications cabling are flammable. Telecommunications spaces therefore have a heightened risk of fire. Frequent access to these spaces, especially when they are congested, exacerbates this exposure, increasing the likelihood of accident. Furthermore, most building codes require that inter-floor pathways be sealed with appropriate fire-stopping material. If TSP cable, conduit, and pathway installations require additional or larger cores through the closets, adequate fire-stopping between those floors must be replaced or added. These installations therefore increase the time and resources the building owner must devote to ensuring that fire-control policies are adhered to.

## D. Liability

Increased security requirements, fire safety issues, closet temperature elevation, use of building power for TSP or tenant electronics—these and other hidden effects of a TSP installation increase the building's liability and operating costs.

# V. COMPETITIVELY NEUTRAL BACKBONES

The deleterious effects of home run telecommunications cable installations and repeated ILEC cable reconfigurations and installations on telecommunications closets within multi-tenant buildings have prompted some building owners to implement a uniform cable distribution system that has the flexibility to meet changing tenant demand and uses limited telecommunications closet space economically. Building owners most commonly create a uniform distribution system in their buildings by declaring MPOE or installing a new uniform cable backbone.

## A. Declaring MPOE

For buildings in which a local exchange company installs or modifies cabling, FCC rules allow building owners to assume control of a building's cable backbone by establishing a demarcation point at which control of (and responsibility for) the inside wiring would shift from the ILEC to the building owner. This process is known as declaring Minimum Point of Entry (MPOE).[18]

Declaring MPOE can be advantageous to competitive service within a multi-tenant building in several ways. The building gains a competitively neutral voice-grade infrastructure attractive to multiple TSPs. Competitive TSPs, often reluctant to connect to an ILEC-owned backbone because of anti-competitive concerns,[19] can serve tenants on a competitively neutral backbone without fear of anti-competitive practices and will benefit from greatly reduced installation costs. If TSPs elect to use the available ILEC cable pairs, tenants would benefit from the elimination of installation delays and from reduced access costs. The building can better control its telecommunications spaces, thus reducing closet and riser congestion and minimizing security, safety, and liability concerns.

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[18] See 47 C.F.R. .68.3.

[19] Concerns include fears of unequal treatment regarding installations and repairs, and fears regarding the need to share confidential market information with the TSP's competitor, the ILEC.

In practice, however, our experience has been that declaring MPOE is not easily accomplished. The ILEC has the right to be compensated for relocating equipment and rearranging cables as necessary to establish a demarcation point, if requested to do so by the building owner.[20] On behalf of its clients, Riser has requested cost estimates for declaring MPOE from seven different ILECs in 33 buildings[21] between May of 1998 and May of 1999. We have yet to receive a single realistic cost estimate in response to our requests. ILECs have simply not responded, refused to cooperate, warned against the pitfalls of pursuing MPOE, demanded pre-approval of MPOE by each tenant in the building, incorrectly defined the cases in which MPOE is applicable or not applicable, and inflated their estimates of MPOE-related costs.[22] Our documentation highlights several issues, including the obvious non-responsiveness of some ILECs to MPOE requests. It is also evident that ILECs view the declaration of MPOE from different perspectives, and their approaches often appear to be at odds with the FCC's intent. In fact, our only experience with building responsibility for an ILEC-installed backbone has been in states where the transfer of ownership has been mandated by the state PUC or by the ILEC tariff. Even in these states, however, the ILEC often manages the cable backbone by default; the reasons for this are often unclear.

When MPOE has been declared and the full responsibility for the inside wire is transferred to the building, the building manager is then responsible for the reliable operation of the cable plant. The lack of access to current cable records, however, further complicates the building owner's task in managing an acquired ILEC backbone. For over fifty years, every multi-tenant building in the country contained a record book that reflected up-to-date information on telecommunications cable usage within the building. Each change to the building's cable backbone usage was documented in the cable record book. In the early 1970s, however, the FCC granted end users the right to connect non-Bell System equipment to the national telephone network. This change, coupled with the subsequent break-up of the Bell System in 1984, abolished the Bell System's custodial role of the inside wire irreversibly.

Unsurprisingly, therefore, over the course of our infrastructure surveys, we have encountered only a handful of remaining cable record books. In every case, the book has not been updated in over twenty years. Today, current cable records are found only in buildings where the property owner has the financial and personnel resources required to track cable usage. In most multi-tenant buildings, the absence of cable records has resulted in repair problems and lengthy delays in the delivery of telecommunications service ordered by the tenant.

We believe that the essence of 47 C.F.R. §68.3 is sound, however, and that, with regulatory clarification, building owners can declare MPOE successfully.

## B. New Uniform Cable Distribution Systems

Even declaring MPOE were a more viable means of establishing a uniform building-owned infrastructure, it is not often practical because the building's ILEC cable backbone is not

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[20] The ILEC may also seek compensation for the existing cabling. Such a claim is inappropriate since the cabling has been fully depreciated and the ILEC has already been compensated for it through general utility payments.
[21] Representing approximately 100,000 sophisticated telecommunications users.
[22] Table 1 shows a sample of ILEC responses in detail.

adequate to meet tenant demand. This is especially true for the infrastructures of older buildings, which obviously were not designed for the telecommunications needs of the 21st-century tenant.

Accordingly, some building owners are installing new uniform cable distribution systems. Such cable systems are typically designed to uniformly and generously distribute cabling throughout the building to meet immediate and long-term tenant demand without the need for the regular reconfigurations that can be so harmful to limited building space. A new uniform cable backbone will also benefit the building in the long term, because it can be designed for the current market's spatial[23] and functional[24] demands. Tenants can benefit from dramatically reduced TSP entry costs and installation intervals and from state-of-the-art, high-quality wiring that supports a wide spectrum of broadband and high-speed services. A competitively neutral telecommunications infrastructure gives tenants ready access to a variety of services from multiple TSPs and can substantially improve responsiveness to tenants' inter-floor needs. A building-owned infrastructure also aids the building owner in managing telecommunications spaces, thus reducing riser and closet congestion and improving security and safety. TSP requests for access no longer necessitate negotiations or construction, reducing the strain on building management resources.

# VI. Examples of Successful Telecommunications Environments

Long term strategic management of multi-tenant buildings can be done only by the building owner—the economics of a fluid tenant community make it nearly impossible through a democratic process, and no regulatory or governmental body could hope to establish rules for the thousands of unique buildings nationwide. Building owners must also, however, have adequate authority to implement long-term management successfully.

Some building owners and managers are actively managing telecommunications activities within their buildings, although their authority to do so is occasionally questioned. They control activities within telecommunications spaces by requiring that TSPs (including the ILEC) execute license agreements for access that define the terms and conditions of access and require that the TSP comply with building rules and procedures for ensuring the efficient use of building spaces. They track telecommunications space access and activity to reduce the building's level of exposure to hazards and liability, reduce closet congestion,[25] minimize security and safety risks, improve the integrity and security of tenant telecommunications services, and improve tenant confidence and satisfaction in the integrity of the building's telecommunications infrastructure.

[23] In older buildings, a 300-pair voice-grade terminal occupies a space approximately 16 in. W x 48 in. H, a significant amount of wall space for what is typically a small closet (these terminals are shown in Exhibit 1, described as the ILEC demarcation point). In contrast, current high-density terminal hardware can support the same 300 pairs in a space that is 11 in. H x 11 in. W.

[24] Older cable and terminals were designed to support strictly voice service. Through advances in technology, manufacturers have had varied success in using these older cables and terminals to support modern services. New cable types and terminals eliminate the need to "shoe-horn" new services onto cable and terminal types that were never designed to support such services.

[25] Exhibit 2 shows photographic images from a managed telecommunications closet.

These same building owners and managers have also been very successful in promoting telecommunications competition within their buildings. By attracting qualified TSPs and reaching mutually agreeable terms for access, they have brought their tenants a greater choice of sophisticated services from a choice of qualified TSPs, all of which are competing for access to a share of the building's tenant base, lowering prices and increasing service quality.

## A. Washington Mutual Tower, Seattle, Washington

Washington Mutual Tower is a 55-story multi-tenant commercial building in Seattle, Washington co-owned by Cornerstone Properties. The owners and managers of Washington Mutual Tower recognized over five years ago the significant and pressing telecommunications demands placed on the building by tenants and TSPs every day. Although the building was only about six years old at the time, many of the telephone/electrical closets on tenant floors were congested with tenant equipment and TSP cables.

In 1995, the building began to change its telecommunications policy to curb the degradation occurring in its telecommunications spaces and increase the telecommunications service options available to its tenants. Today, the condition of the building's telecommunications infrastructure is significantly improved:

- Telecommunications closets are clearer; most of the tenant and TSP equipment that was located in building space has been relocated to tenant- or TSP-controlled space.

- Cables routing through building telecommunications closets are now labeled with the owner of the cable and the date of the installation. When tenants vacate the building, cables serving them are removed, thereby halting the incremental increase in abandoned cable in the closets.

- All TSPs seeking access to serve the building's tenants must sign a telecommunications license agreement that defines the TSP's relationship with the tenants and the building, establishes standards for the craftsmanship and quality of the work performed in the building, and is subject to renewal on a regular basis. These and other terms and conditions clearly define the rights and responsibilities of both the building and the TSP.

- By the end of September 1999, installation of uniform copper and fiber-optic cable backbones in the building will be complete. The building is also concurrently developing secure TSP equipment spaces adjoining the Main Cross-connect area. The new backbones are designed to serve the short-term and long-term needs of all of the building's tenants, allow TSPs ready access to tenants, and give tenants greater choice in cutting-edge telecommunications services. This investment is expected to spur TSP competition for tenant business. In fact, one TSP, Teligent, is so eager to use the new systems that it has made a temporary connection to the partially installed cable system to serve its customer in the building until the cable installation is complete.

Washington Mutual Tower is already served by half a dozen competitive TSPs, and more are seeking access to the building every day. The clamor for competitive TSP access is so strong that building management is facing two very real possibilities: (1) that it will need to identify even more space in the building to accommodate TSPs, and (2) if reapportioning existing space is impossible or unsuccessful, it will need to develop criteria to screen the TSPs that are granted access to conserve space.

## B. Shorenstein Portfolio, California

In several states, including California, ILEC tariffs or PUC rules have transferred control of the ILEC's inside wire to the owner of a multi-tenant building. The Shorenstein Company is one real estate firm that has seized this opportunity to better manage its buildings' telecommunications infrastructures. Shorenstein employs a third-party inside wire management company to coordinate and manage all aspects of the old Pacific Bell voice-grade cable in its multi-tenant buildings. This involves maintaining an accurate inventory of assigned cable pairs, responding to TSP or tenant requests for service, repair, or access, and coordinating closet access with TSP technicians and building security. This strategy allows Shorenstein to tightly control its building space, track telecommunications activity and cable capacity, and reduce its safety, security, and liability concerns. More important, however, Shorenstein's actions have brought its tenants a wide choice of competitive telecommunications services, from over a dozen TSPs, while improving tenants' confidence in the integrity of their telecommunications service.

## C. The New York Information Technology Center at 55 Broad Street, New York City

Rudin Management Company pioneered a new concept in real estate by retrofitting 55 Broad Street in New York City with a state-of-the-art communications distribution system. Tenants use building-owned fiber-optic and high-speed copper cables to access five CLECs, seven long-distance carriers, and eleven ISPs at the building dubbed the New York Information Technology Center. The building's redundant system delivers up to 100 Mbps of bandwidth to each tenant. The building has attracted bandwidth hungry tenants that can choose from a plethora of sophisticated services—videoconferencing, tenant LAN, satellite communications, high-speed Internet access—at prices reduced by the elimination of TSP cable installation costs. For example, tenants at 55 Broad Street save approximately $2,000 in monthly charges for a T.1 line.[26] Rudin's benefits from this approach are also many: managed telecommunications spaces, tenant telecommunications needs met on demand, and a fully leased building, to name a few. Rudin continues to apply its high-tech approach to its other properties; 110 Wall Street is equipped with a state-of-the-art wireless voice and data distribution system, including fiber-optic and high-speed copper backbones. Rudin and other like-minded real estate companies, seeking to satisfy tenants, recognize the real value that competitive telecommunications choice holds for their properties, and promote this choice when marketing their buildings.

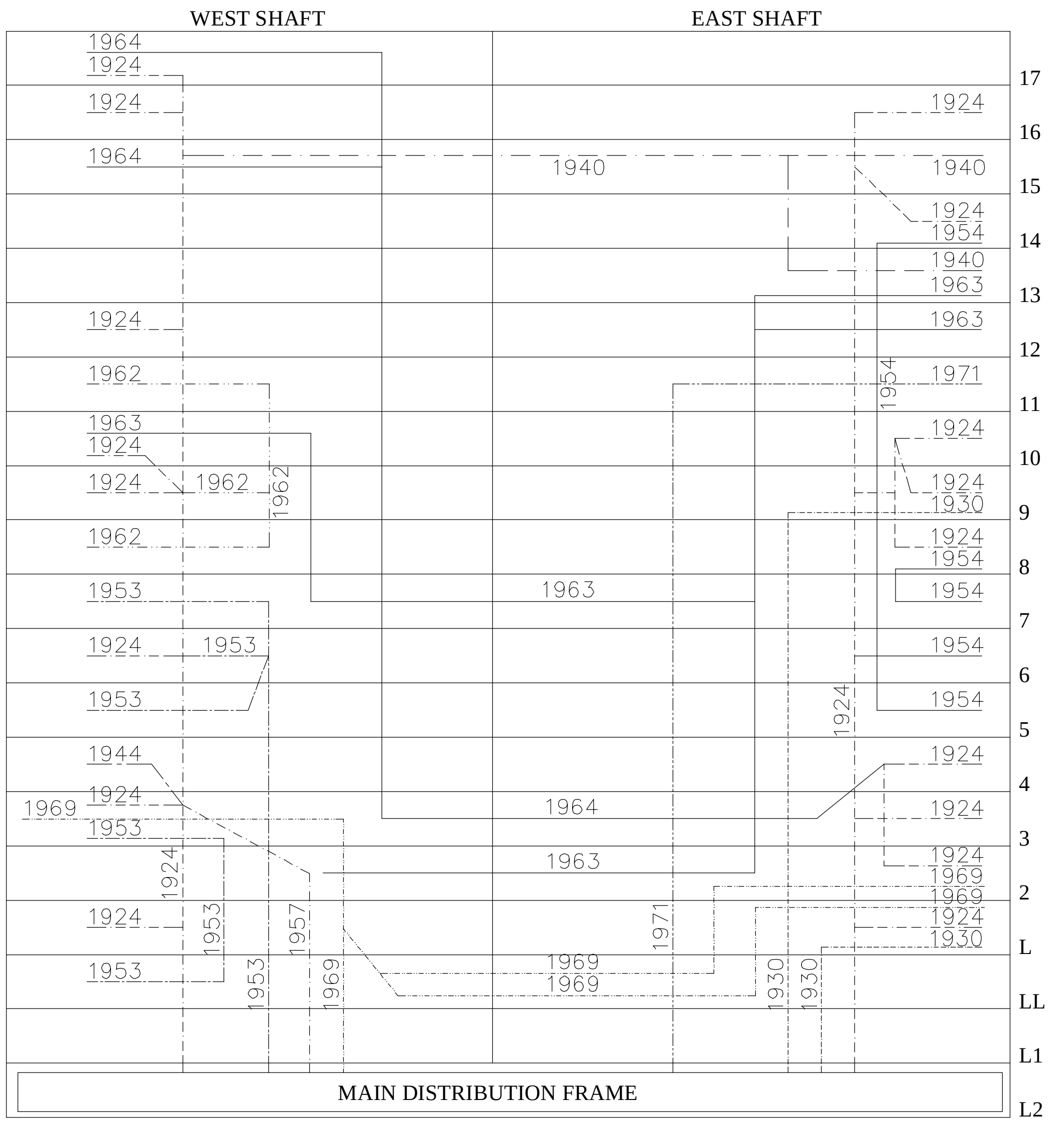
[26] "High-tech high rise," *Communications News,* October 1997.

## Table 1
## History of MPOE requests and ILEC Responses regarding MPOE Relocation Costs Pursuant to 47 C.F.R. §68.3

| ILEC | State | No. of Buildings | ILEC Response |
|---|---|---|---|
| Ameritech | Ohio | 1 | This type of work is regulated by tariff and is billable to the party making the request. Rearrangement of these lines will be very costly and difficult. All work must first be pre-approved by each and every tenant. |
| Ameritech | Indiana | 1 | Ameritech's rough breakdown of claimed costs is $278,415. |
| Bell Atlantic | New Jersey | 1 | If Bell Atlantic is requested to move its demarcation point to the MPOE, in order to recover its stranded investment, and pursuant to FCC accounting rules, it would have to receive compensation in the amount of Bell Atlantic's net book cost of the house and riser cable. In addition, the responsibilities of Bell Atlantic and the client would have to be defined, in connection with the maintenance and repair of the riser facilities and procedures agreed upon for ensuring that each customer in the building has been notified of the party that will be responsible for maintenance and repair.<br>Bell Atlantic also states that while they respect an owner's request to purchase the house and riser and establish MPOE, Bell Atlantic will need a means to reach customers desiring their service without the imposition, by either the building owner or operator of the riser, of fees on their provision of services. |
| Bell Atlantic | New York | 3 | If Bell Atlantic is requested to move its demarcation point to the MPOE, in order to recover its stranded investment, and pursuant to FCC accounting rules, it would have to receive compensation in the amount of Bell Atlantic's net book cost of the house and riser cable. In addition, the responsibilities of Bell Atlantic and the client would have to be defined, in connection with the maintenance and repair of the riser facilities and procedures agreed upon for ensuring that each customer in the building has been notified of the party that will be responsible for maintenance and repair.<br>Bell Atlantic also states that while they respect an owner's request to purchase the house and riser and establish MPOE, Bell Atlantic will need a means to reach customers desiring their service without the imposition, by either the building owner or operator of the riser, of fees on their provision of services. |
| Bell Atlantic | Washington, D.C. | 4 | Bell Atlantic indicates that it does not normally provide any research work of this type. Separate conversations indicated that no cost estimate would be provided without a firm order. |
| BellSouth | Georgia | 3 | BellSouth is not in a position to relocate the demarcation point to the MPOE at any of these properties at this time. Separate conversations indicated that MPOE is applicable to new buildings only. BellSouth does not maintain records on inside wire beyond the demarcation point. All other cabling and wiring is considered proprietary and unavailable to building owners. |
| BellSouth | North Carolina | 1 | BellSouth specified that subscribers must first approve any move of their demarcation point(s). Before incurring charges to obtain records regarding inside wiring, limited to the disclosure of non-proprietary information, BellSouth strongly suggests that building owners carefully consider the practical value of the information. |
| BellSouth | South Carolina | 3 | BellSouth specified that subscribers must first approve any move of their demarcation point(s). Before incurring charges to obtain records regarding inside wiring, limited to the disclosure of non-proprietary information, BellSouth strongly suggests that building owners carefully consider the practical value of the information. |
| BellSouth | Florida | 1 | BellSouth claims the Florida PSC's rule requires them to establish the demarcation point for its services directly in each tenant's space. The General Subscribers Tariff is cited, specifying that the demarcation point must be located within the customer's premises at a point easily accessed by the customer. Their interpretation is that establishing MPOE is not applicable within the state of Florida. |

| ILEC | State | No. of Buildings | ILEC Response |
|---|---|---|---|
| GTE | Florida | 1 | Request letter was forwarded to GTE's attorney. No further response. |
| SNET | Connecticut | 3 | Quoted price of $104,559.38 for the declaration and implementation of MPOE. This cost is for moving cables only; actual cross-overs are additional costs. |
| Southwestern Bell Telephone Co. | Texas | 8 | Southwestern Bell provided an estimated cost of researching and copying cable records and work associated with the establishment of MPOE at a representative building. Client must agree to pay $10,139.73 prior to commencement of any work. |
| Southwestern Bell Telephone Co. | Missouri | 1 | Refused to provide requested information because the cable is Southwestern Bell's network cable. |
| U S WEST | Minnesota | 2 | No response. |

**Figure 1**
**Sample Diagram of Early Bell System Cable Backbone Installation Practice**




This is a schematic representation of a Bell System–installed cable plant of a 75–year–old multi–tenant commercial building in downtown Chicago. This diagram is based on an Illinios Bell blueprint from building management files. Notes on the blueprint indicate that it was last updated on January 5, 1972.

**Figure 2**
**Uniform Cable Backbone Design**

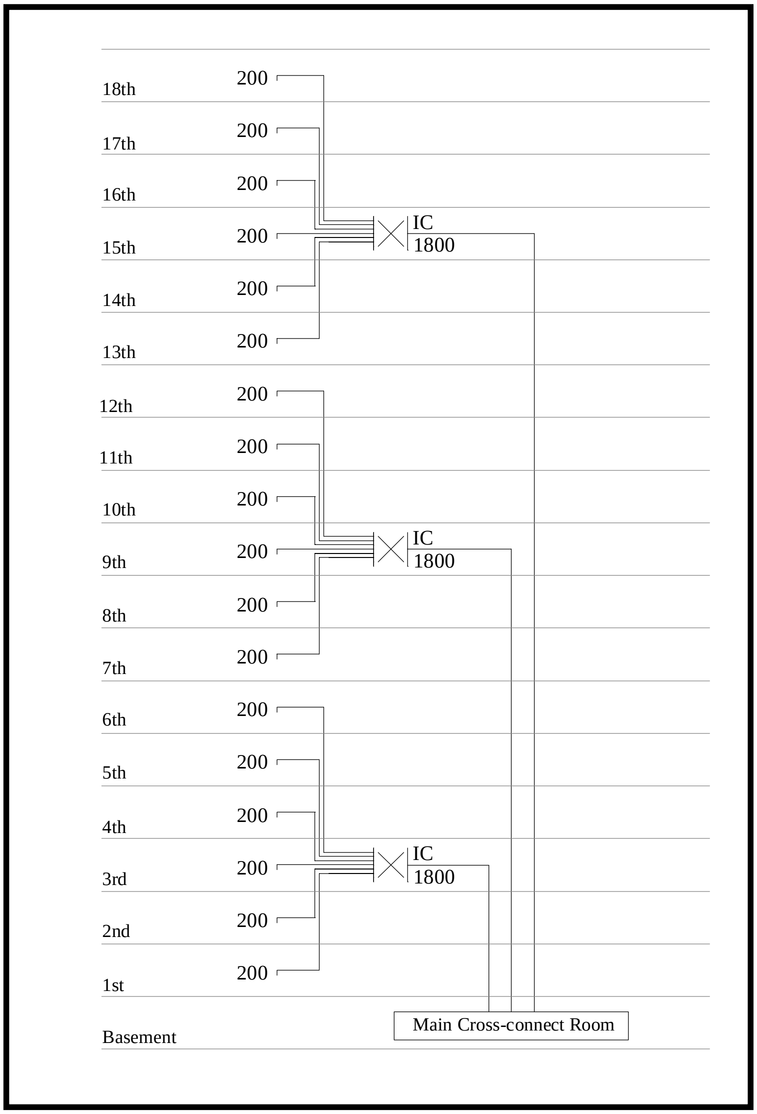



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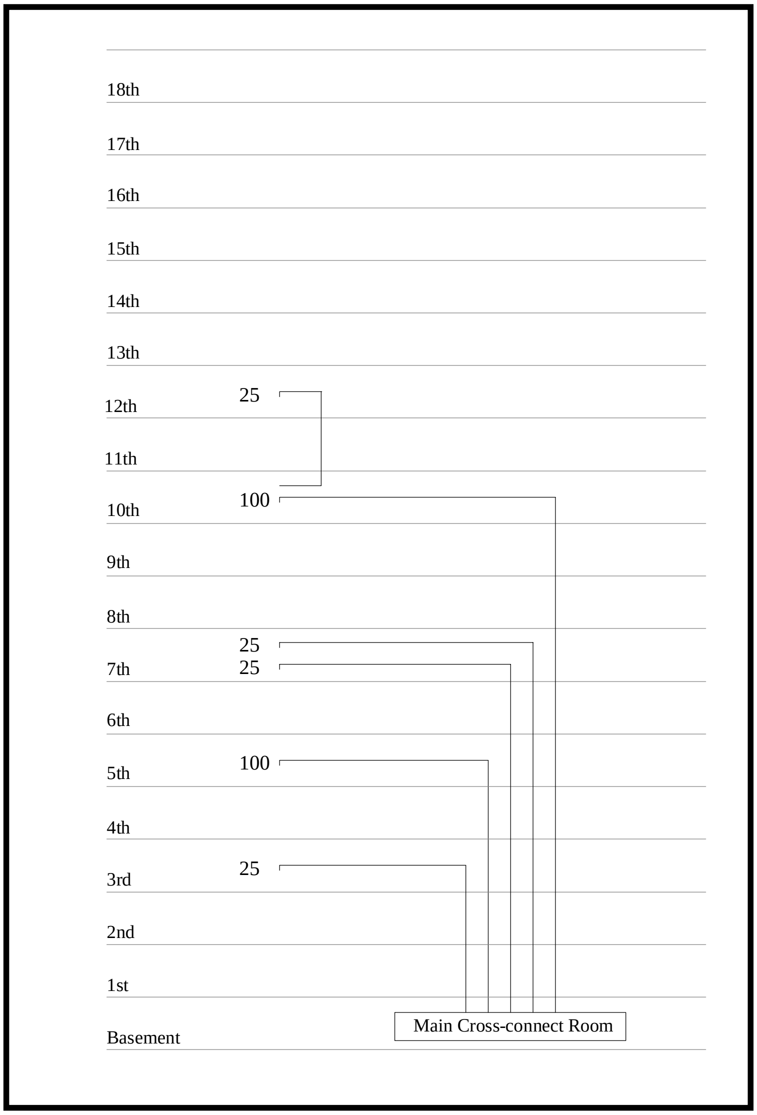
**Figure 3**
**Home Run Cable Backbone Design**



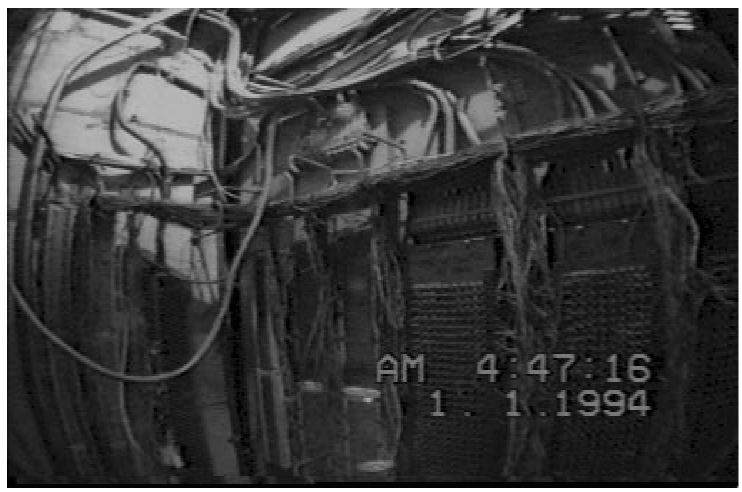
## Exhibit 1
## Failed Telecommunications Closet

This telecommunications closet is located in a 40-year-old 38-story commercial office building. One the lower floors, core building space contains two closets—a telephone/ electrical closet and a telephone closet (on upper floors, where the footprint of the building reduces in size, there is only one closet). These images were taken from a telephone closet, approximately 4 ft. x 8 ft. in size, on a lower floor.


The first image is a view of the upper area of the closet along the 4-ft. wall. Note the jumble of cables against the back wall. All of these cables serve tenant equipment, 90% of which is no longer in service and should be removed.

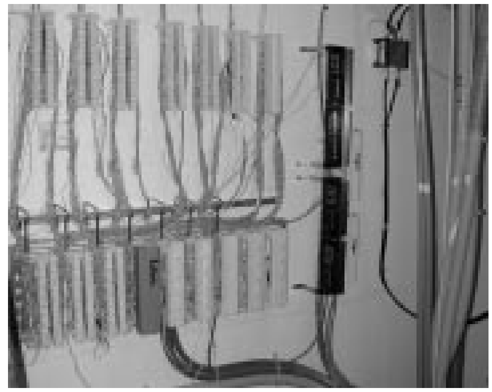
The remaining two images show different views of the 8-ft. wall. The rectangular shapes in the lower right quadrant of the second image and on the left quadrant of the third image represent the ILEC demarcation point.

These two images appear to be distorted because a wide-angle lens had to be used to capture the tight space.



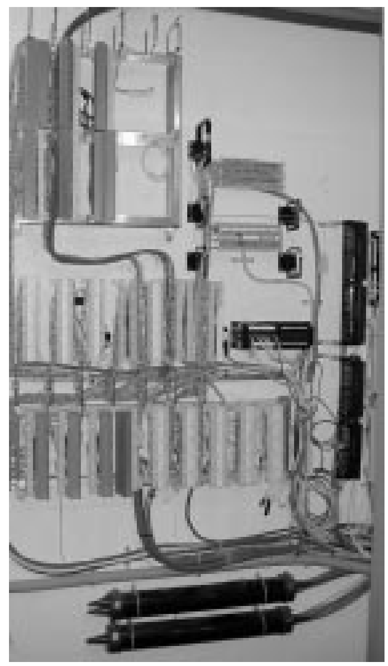

All three images appear dark because the space *is* dark. Although ample light is present at the ceiling, a latticework of cables crisscrosses overhead, preventing light from reaching the lower, working areas of the space where adequate light is crucial to identifying color-coded telecommunications wires and otherwise working effectively.

**Exhibit 2**
**Managed Telecommunications Closet**



This telecommunications closet is located in a 30-year-old, multi-tenant commercial office building in New York City's financial district. In 1995, the building's key infrastructures, including telecommunications, were completely removed and re-built.

The building has deployed multiple fiber-optic and copper cables in sufficient density to support forecast tenant demand. In part because of the ready access to sophisticated telecommunications services, the building is nearly 100% occupied. The tenant base is comprised of companies that rely on telecommunications for their operations.



These three images were all taken from the core telecommunications closet serving floor 10 of this 31-story building. The first two images show portions of the closet that contain building and tenant telecommunications facilities. Note that the walls are light in color and that the space is well lit. The closets were designed with these features to facilitate economical and effective management of the spaces. Because all activities in the spaces are actively managed, undesirable items such as tenant electronics, building electrical facilities, inactive equipment, trash, and stored items are absent.

The third image shows the array of cables that pass from floor to floor through this closet. This is a representative example of the impact such cables have on closet floor *and* wall space. This vertical cable array consumes 12 sq. ft. of floor space and over 50 sq. ft. of wall space.